THURSDAY, JUNE 28, 1888.

THE EARLY CORRESPONDENCE OF CHRISTIAN HUYGENS.

Œuvres Complètes de Christian Huygens publiées par la Société Hollandaise des Sciences. Tome Premier : Correspondance 1638–1656. (La Haye : Martinus Nijhoff, 1888.)

NEVER before, we venture to assert, even in this age of "complete editions," has so colossal a literary monument been raised to the memory of a great man as the edition of the works of Christian Huygens, of which the first instalment now lies before us. In a huge and splendid volume of 621 quarto pages, is contained the correspondence, from his ninth to his twenty-eighth year, of the "young Archimedes," as his friends delighted to call him. Yet out of 2600 documents in the hands of the Commission charged by the Amsterdam Academy of Sciences with the superintendence of the publication, no more than 365 have as yet been printed. Seven additional tomes, at least as massive as that just now issued from the press at the Hague, will be needed to bring to completion the initial section of the comprehensive record. The works of Huygens, edited and inedited, will follow, with an elaborate biography, so that we may safely assume that the present century will not see the end of an enterprise the pecuniary responsibility of which has been generously undertaken by the Scientific Society of Holland.

We have nothing but praise to accord to the manner in which it has so far been conducted. All selective difficulties were indeed spared to the Commission ; for the collection at Leyden was of such exceptional value that their resolution to print everything it contained admitted of no cavil, and was arrived at without hesitation. Room was, however, left for discretion as to the manner of presenting to the public the materials at their disposal ; and it has been wisely exercised. The notes are elucidatory without being obtrusive ; the prefatory remarks are few and to the point ; the indexes (of which there are no less than five) afford a satisfactory clue to a labyrinth of close upon four hundred letters in Latin, French, and Dutch, miscellaneous in their contents, and necessarily chronological in their arrangement. They are of great and varied interest. Scientific history, the dispositions and modes of thought of "men of light and leading" in the seventeenth century, the manners and customs of the time, are all in turn illustrated by them ; above all, their perusal offers singular advantages for studying the development of the powerful and active mind of the protagonist in the life-drama they partially unfold.

Christian Huygens was born at the Hague, April 14, 1629. Every educational advantage which the age could afford was showered upon him. His father, Constantine Huygens, was distinguished as a statesman, a poet, a man of letters, and a musician. Himself a product of the most varied culture, he desired that none of the brilliant faculties early apparent in his two elder sons should rust in disuse. They were accordingly taught to sing and play the lute as well as to compose Latin verses ; they attended the juridical lectures of Vinnius, and studied mathematics under Van Schooten ; they were accomplished in dancing and drawing no less than in Greek, rhetoric, and logic ; they travelled to see the world and improve their manners ; they could, as occasion required, play the courtier, or work as skilled mechanics. The native turn of each was, however, different. Constantine excelled in the lighter branches of literature ; Christian promptly shot ahead of him in geometry. Study and invention went, with him, in this direction, hand in hand. Before he was seventeen, he had begun to strike out original lines of investigation, and the promise of these juvenile essays was discerned, among the first, by Descartes. Mersenne about the same time opened a correspondence with him, and predicted for him greatness beyond that of the towering figure of Archimedes.

He made his *début* in print in 1651 with a treatise on quadratures, to which he appended a refutation of the theorems on the same subject of Gregory of St. Vincent, with the unusual result of gaining (besides many admirers) a friend in the person chiefly interested in the controversy. The little book was received with acclamations of praise. At once and everywhere, the genius of its author was acknowledged. The mathematicians of France, England, and Germany vied with those of Holland in doing him honour. He was lauded as "Vieta redivivus," placed on a level with Pappus and Apollonius, hailed as the great coming light of science. Yet it was not in pure mathematics that his brightest laurels were to be gathered. Many lesser men did more to help on the great revolution in method which signalized his age. He remained, throughout its progress, constant to the ancient models, and looked on, indifferent or averse to changes the full import of which he failed to realize. His extraordinary ability was, however, never more conspicuous than in his successful grappling with problems—such as that of the isochronous curve—unapproachable by geometers of a more common-place type without the aid of the calculus ; and there is reason to think that, had he lived longer, he would have reinforced his powers by its adoption. It appears from a letter of Leibnitz to him, of October 1, 1693, that he was just then, eighteen months before his death, "beginning to find the convenience" of the infinitesimal mode of calculation, and had gone so far as to express publicly his approbation.

The most interesting part of the correspondence now before us refers to Huygens's observations on Saturn. As early as November 1652, we find him making inquiries as to the best manner of preparing and polishing lenses. Assisted by his brother Constantine, he prosecuted the subject with a diligence for which he half apologized to his learned friends, and which produced unwelcome gaps in his communications with them. By the commencement, accordingly, of 1655, he was in possession of a telescope of 12 feet focal length, undoubtedly the best produced up to that date. It showed him, not only the phases of Venus and the satellites of Jupiter, but—March 25, 1655—"aliud quid memorabile," unseen by Fontana or Hevelius, namely a Saturnian moon, afterwards named Titan, the sixth counting outward from the planet, the first in order of terrestrial detection. He concealed and endeavoured to secure his discovery, after the fashion set by Galileo, in an anagram which was widely

© 1888 Nature Publishing Group

circulated, and expounded in the following year. The precaution was nevertheless insufficient to prevent a claim to priority being put forward. Dr. Wallis, the Savilian Professor of Geometry, prepared on behalf of his friends Wren and Neile, a storage-battery of fame in the shape of a counter-anagram, which—if Huygens's private notes are to be relied upon—he fraudulently interpreted as an announcement similar in purport to that imparted to him from the Hague. Some unexplained circumstance possibly underlies a transaction on the face of it highly discreditable to our countrymen. The pretensions of the English observers were at any rate quickly and quietly withdrawn, and Huygens was left in undisturbed enjoyment of the credit most justly due to him.

Shortly after his return from Paris, late in 1655, he constructed a telescope of 23 feet, magnifying one hundred times; and the comparison of the observations it afforded him with those of the previous year enabled him at once to penetrate the mystery of Saturn's enigmatical appendages. His hypothesis as to their nature, wrapt up in the customary logogryph, was appended to his little tract on the Saturnian satellite, with an accompanying prediction of the future changes of figure to be expected in the planet. Its verification, however, falls outside the limits of the publication we are at present concerned with. Nor does it include any mention of the novel sight disclosed to Huygens by his improved instrument in the constellation of Orion, where a certain "hiatus" in the firmament permitted (as he supposed) the pure, faint splendour of the empyrean to shine through on his amazed vision.

Huygens had an eminently sane and sagacious mind. His fortunate intuitions were numerous, and the investigations they suggested were singularly solid and complete. A great part of his work was thus fitted to be, and has actually become, the substructure of the modern scientific edifice. He was, however, less happy in the few cases in which, relaxing his habitual prudence, he gave the rein to speculation. His prevision that the measure of discovery in the solar system was filled by the disclosure of Titan, was belied with scarcely civil haste by Cassini's further detections hopelessly overthrowing the numerical balance between six primary and six secondary bodies. And the surmises which constituted the bulk of his "Cosmotheoros" were, for the most part, infelicitous. Yet he reprehended, as woven out of figments, the Cartesian theory of the origin of the universe, and concluded with the wise and memorable words:—"To me it would be much if we could understand how things actually are, which we are far enough from doing. How they were brought about, what they are, and how begun, I believe to be beyond the range of human ingenuity to discover, or even by conjectures to approach."

A. M. CLERKE.

NORWEGIAN GEOLOGY.

Bömmelöen og Karmöen med Omgivelser. Geologisk beskrevne af Dr. Hans Reusch. (Kristiania: Published by the Geological Survey of Norway, 1888.)

THE attention of geologists in all parts of the world has for some years been concentrated upon the crystalline schists, which have so long presented insuperable difficulties to those who would explore their origin. Little by little the darkness has been rising from these ancient foundation-stones of the earth's crust; and though a long time must probably still elapse before their history can be even approximately sketched, there can be no doubt that we are now at last on the right road of investigation. Fresh evidence is continually being obtained from the most widely-separated regions, and each additional body of facts goes to support the view that the schistose rocks are the records of gigantic terrestrial displacements, whereby portions of the crust have been pushed over each other, and so crushed and deformed as to acquire new internal rock-structures. Out of these mechanical movements, with their accompanying chemical transformations, a true theory of metamorphism will no doubt eventually be evolved. In the meantime it is too soon to generalize; what we need is a far larger mass of observations. The subject is a wide one, for it involves the labours of the field-geologist, the petrographer, the mineralogist, the chemist, and the physicist. And only by the united exertions of these fellow-workers can we hope for good progress and solid results.

The most recent contribution to the question of the origin of the crystalline schists has just appeared in the form of a handsome volume, by Dr. Hans Reusch, on the Bömmel and Karm Islands off the mouth of the Hardanger Fjord. It consists of a mass of detailed observations on the structure of the crystalline rocks of that part of the Scandinavian coast, and furnishes an admirable array of fresh data for the study of the problems of regional metamorphism. Dr. Reusch's previous researches on the compressed conglomerates and metamorphosed fossiliferous rocks of the same district were of the utmost value in the discussion of the question, and he now augments these by new details from the surrounding region.

Especially important are the numerous illustrations of the effects of pressure and stretching in the production of the well-known structures of the crystalline schists. The strangely deceptive resemblance to stratification resulting from these processes is exhibited in many examples. Excellent instances are likewise given of the production of foliation in dykes. Eruptive diabases and gabbros are shown to pass into dioritic rocks, and hornblendic schists and granite into various foliated compounds. More novel features of the essay are the careful studies of the deformation and foliation of what were unquestionably at one time ordinary sedimentary deposits—sandstones, conglomerates, and limestones. It is shown, for instance, that in a mass of still recognizable conglomerate the planes of stratification are cut across, almost at right angles, by those of foliation, while the lines that mark the direction of stretching or deformation slant upwards across the latter.

Dr. Reusch brings forward some remarkable observations regarding the connection between conglomerates and granitic rocks. He thinks that in some places what is now granite has resulted from the metamorphism of what was originally a breccia or conglomerate composed of fragments of granite, gneiss, quartzite, and quartz. The quartzite and quartz, being less liable to change, remain still visible, while the granite and gneiss have passed into common granite. In another locality he

© 1888 Nature Publishing Group